

6.1 INTRODUCTION

It is apparent from *Section 3* that whilst secondary impacts have and continue to be identified from roads and road transport, many issues are poorly understood and there are gaps in the information. This section focuses on recommendations for further research, the aim of which would be to provide improved guidance, both regarding potential impacts and possible mitigation measures.

6.2 NEED FOR FURTHER RESEARCH

Further research is required in many areas including the following:

- a fuller understanding of the impacts;
- the interaction between combinations of impacts (eg fragmentation, noise and artificial lighting);
- the cumulative impacts resulting from the above and also from a number of different road schemes;
- effectiveness of current mitigation;
- costs associated with provision of mitigation and proportional benefits to wildlife and costs of inadequate mitigation;
- proposals for improved mitigation;
- predictive techniques for allowing wider analysis at the planning stages.

Many of the above would benefit from a greater commitment on behalf of highways agencies to monitoring of the "before, during and after" situations.

Options for further research are presented in *Table 6.2a* below and the work proposed by the Highways Agency is highlighted in *Section 6.3*.

Table 6.2a Future Research Needs

Issue	Research
Air pollution	<p>Contributions to acid deposition and climate change of individual and cumulative schemes.</p> <p>Distance from roads over which effects of air pollutants occur on flora and fauna.</p> <p>Effects on fauna.</p> <p>Use of critical loads as an analytical technique for cumulative analysis.</p>
Noise and Disturbance	<p>Effects of road noise on woodland birds in UK and for other habitat types.</p>

Issue	Research
Artificial Lighting	<p>Effects of audible and non-audible noise on other wildlife.</p> <p>Field experiments of effects of road lighting especially on woodland species and nocturnal species.</p> <p>Effectiveness of existing low brightness lighting and other mitigatory measures including light shields <i>etc.</i></p> <p>Effects of non-visible road light components on fauna and flora.</p> <p>Investigation of new techniques for "wildlife and habitat friendly" road illumination.</p>
Aquatics	<p>Reedbed technology and contamination build up.</p> <p>Efficiency of lagoons, reedbeds and swales.</p> <p>Success of replacement, substitute ponds.</p> <p>Definition of acceptable water quality standards for fauna and flora.</p>
Fragmentation and Species Movement and Wildlife Casualties	<p>Analysis of the effects of bridges on severance of other pathways.</p> <p>Part of population using a wildlife passage is it for dispersal or home range movements and how do they contribute to population survival?</p> <p>Development of threshold values for fauna and flora and key indicator species.</p> <p>Effects on reptiles.</p> <p>Long term viability of populations of networks of small woods.</p> <p>Optimum ratio of large to small woods.</p> <p>Importance of buffer zones for fauna and flora.</p> <p>Development of cost-benefit analysis techniques for different strategies for avoiding fragmentation effects and of mitigation methods where fragmentation has occurred.</p> <p>Analysis of the BTO ringing recoveries from bird casualties to assess location, cause of death, proportion of road victims <i>etc.</i></p> <p>The scale of wildlife road casualties in the UK and determination of whether road mortalities are prejudicial to populations of particular species and if so, what measures are effective in averting such pressures.</p> <p>Investigation into the use of standard wildlife passage designs for all groups.</p> <p>Influence of seasonal movements and gender on road casualties.</p> <p>Improved mapping of blackspots on existing roads.</p> <p>Build up of contamination levels in the food chain of roadside predators and scavengers.</p>

Issue	Research
Litter	Scale of the problem and effects on fauna and flora.
Roadside Verge Management	Review of success of roadside verge creation and management for nature conservation. Nature conservation value of roadside treeplanting. Evaluation of costs and benefits of non parallel dualling of roads for nature conservation.
Other Effects	Visual effects of roads on wildlife. Contamination effects of de-icing salt and effects on wildlife. Disturbance effects of human presence associated with road construction.
Cumulative	Development of predictive modelling techniques (eg INFOSNIP in the Netherlands for habitat fragmentation (Piepers, 1995)). Development of integrated solutions.

Other issues which should be encouraged are:

- increased Strategic Environmental Assessment (SEA) to permit more accurate identification of the cumulative impacts of road schemes;
- more detailed consideration of secondary issues in EAs at the earliest possible stage in the planning process;
- notification of badgers as a road traffic hazard which would make the need for incorporation of mitigation measures compulsory, as is the case for deer;
- long term monitoring of road schemes covering "before, during and after" scenarios.

6.3

PROPOSED RESEARCH

It is understood that the Highways Agency proposes the following areas for research which will commence in 1996 or 1997 (*pers comm* Highways Agency, 1995):

- assessment of impacts of new or improved roads on wildlife in terms of road casualties with the aim of developing methods to better predict where casualties are most likely to occur so that mitigation can be targeted properly; and
- impacts of recently constructed roads on protected sites such as NNRs and SSSIs with particular emphasis on the success of mitigation measures (including grassland translocation).

Additional work may also be proposed including on otters, bats and great-crested newts if resources are available.

Where other research is already ongoing into a particular topic this has been noted in the preceding text.

The following conclusions can be drawn from this study:

- secondary impacts to nature conservation from roads and road transport are recognised, however, they are on the whole poorly understood;
- central to this is the lack of research on specific issues which stems from the traditional lack of commitment (and resources) by organisations with highways responsibilities (*eg DoT, Highways Agency, County Councils etc*) into funding such work - many of these organisations are, however, beginning to reverse this trend;
- cumulative impacts are rarely considered although increasing commitment to strategic environmental studies will improve the level of understanding of these impacts;
- coverage of secondary issues in environmental assessments (EAs) of road developments has to date been sporadic and not comprehensive;
- fragmentation, isolation and associated effects (*eg wildlife casualties*) are key issues and have been more extensively studied, however, understanding of the significance of wildlife casualties on populations for example, typically remain unanswered;
- impacts from individual road schemes differ and more detailed research in before, during and after situations are required;
- mitigation options may be based on strategic measures such as, policy decisions to help reduce air pollution and/or specific measures such as wildlife passages to reduce fragmentation impacts and wildlife casualties;
- the success of mitigation measures which are implemented is rarely investigated and thus, the impacts of "mitigated schemes" are seldom certain;
- the requirements for further research are numerous and a focused programme of research is recommended - key issues include the implications of:
 - fragmentation/isolation and associated effects such as barrier effects, wildlife casualties, edge effects, buffer zones *etc*;
 - noise and lighting impacts including effects outside human detection levels *eg ultra and infra frequencies*;
 - air pollution effects on fauna;
 - management of roadside verges for nature conservation;
 - cumulative impacts including predictive techniques;
 - monitoring the success of current mitigation measures.

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Annex A

Consultees

Consultees

Organisation	Contact Name
Alfred McAlpine Construction Ltd	Rosanna Joel
Anthony Walker & Partners	Elizabeth MacKenzie
Bristol Regional Environmental Records Centre	Karen Turvey
British Bryological Society	R C Stern
British Deer Society	Hugh Rose Scottish Secretary
	Jeannette Lawton Vice Chairman
British Ecological Society	Hazel Norman (Dr David Walton Chair of Ecological Affairs)
British Herpetological Society	Mrs Green
British Phycological Society	Dr David M John Chair BPS Conservation Committee
British Trust for Ornithology	Dr Jeremy Greenwood Director
Carl Bro Group	Steve Wallace
Cheshire County Council	Ian Marshall
Chris Blandford Associates	Nicki Mudridge
Council for the Protection of Rural England	Paul Hamblin Environmental Assessment and Transport Officer
Countryside Council for Wales	Dr Simon Bilsborough Senior Economist
Cresswell Associates	Warren Cresswell
Department of the Environment	John Rae Air Quality Division
Department of the Environment	David Waterman European Wildlife Division
Department of the Environment	Philip Callaghan Global Atmosphere Division
Department of the Environment	Janett Miller Water Quality Policy
Department of Transport	Tim Fairclough Highways, Policies and Programmes
Devon Wildlife Trust	May Rose-Lane
Ecoscope	David Hill
English Nature	Alastair Burn Environmental Impacts Team
English Nature	Dr Tony Gent Lowlands Team
English Nature	Mary Gibson Uplands Team

Organisation	Contact Name
English Nature	Phil Grice Uplands Team
English Nature	Tony Mitchell-Jones Lowlands Team
English Nature	Keith Kirby Lowlands Team
English Nature	David Sheppard Lowlands Team
English Nature Cumbria Team	Paul Glading
English Nature Dorset Team	Douglas Kite
English Nature Essex, Hertfordshire and London team	Gordon Wyatt Andy Gordon
English Nature Kent Team	Richard Collingridge
English Nature Northumbria Team	Chris Shaw
English Nature Somerset and Avon Team	Michael Woodhouse
English Nature Sussex and Surrey Team	Peter Tinning
English Nature Thames and Chiltern Team	Graham Steven
Essex Bird Recorder	Mike Dennis
Forestry Authority Scotland	Alistair T Jones Development Officer (Scotland)
Forestry Authority Wales	Ruth Jenkins Environmental Officer
Forestry Commission Research Division	Dr Robin Gill Woodland Ecology Branch
Forestry Commission	Dr P Freer-Smith Research Division
Forestry Commission	Harry Pepper
Foundation for Water Research	A R Agg Technical Adviser
Friends of the Earth	Tim Rice Senior Research Officer Biodiversity and Habitats Unit
Game Conservancy Trust	Dr Nick Sotherton
Green Environmental Consultants	Jacqui Green
Hawk and Owl Trust	Colin Shawyer Director - Conservation and Research
Herpetological Conservation Trust	-
Herpetological Conservation International Ltd	Jim Foster
Highways Agency	Paul Foster

Organisation	Contact Name
Institute of Ecology and Environmental Management	Sue Everett Development Officer
Institute of Environmental Assessment	Roger Tindale Research Officer
Institute of Lighting Engineers	Richard Frost Chief Executive
Institute of Terrestrial Ecology	Prof T M Roberts
Institute of Terrestrial Ecology Furzebrook Research Station	Dr J A Thomas Nigel Webb
Kent Trust for Nature Conservation	Andrew Craven Senior Conservation Officer
Mammal Society	Julia Hanmer Information and Development Officer
Ministry of Agriculture, Fisheries and Food Land Use Planning Unit	B M Linscott Assistant Regional Planning Officer
Natural Environment Research Council	Dr R K G Paul
National Federation of Badger Groups	Mr J Taylor Ernie Parsons Pamela Mumford
National Rivers Authority	Dr Andrew Brookes, Director NRA Environmental Assessment
National Rivers Authority	Mike Williams Conservation/Recreation Officer
National Trust	David Houston
Northumberland Wildlife Trust	Martin Twiss Otter Officer
Northumberland Wildlife Trust	Lisa Kerslake
Otter Trust	Richard Shuter Conservation Officer
Penny Anderson Associates	Penny Anderson
Plantlife	Miles King Conservation Manager
Royal Entomological Society	G G Bently Registrar
RSPB	Barnaby Briggs
RSPB	Leigh Lock
RSPCA	Helen McLaughlan
Scottish Natural Heritage	Peter Rawcliffe Strategic Issues Branch
Scottish Wildlife Trust	Peter Smith Transport Campaign Researcher
Scottish Wildlife Trust	Leonie Alexander
Vincent Wildlife Trust	Mr O'Connor Secretary
Water Research Council	Chris Mainstone Senior Scientist Ecological Assessment Group

Organisation	Contact Name
Wildlife Trust Beds, Cambs, Northants	Tim Barfield Adrian Colstan
Wildlife Trust Berks, Bucks and Oxon	Iain Corbyn
Wildlife Trust Bristol, Bath and Avon	Andrew Cadwallader Conservation Assistant
Wildlife Trust Cheshire	Chris Mahon
Wildlife Trust Durham	Steve Lowe
Wildlife Trust Essex	Anthony Muller Planning Conservation Officer
Wildlife Trust Herts and Middlesex	Martin Baker
Wildlife Trust Lancashire	Dr Janet Edmunds Conservation Officer
Wildlife Trust Northumberland	Lisa Kerslake
Wildlife Trust Surrey	Jill Barton
Wildlife Trust Urban - West Midlands	-
Wildlife Trust Warwickshire	Neil Wyatt Conservation Manager
Wildlife Trust Wiltshire	Gareth Morgan Senior Conservation Officer
Woodland Trust	John James Executive Director
World Conservation Monitoring Centre	Dr Michael J B Green Acting Head, Protected Areas